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ABSTRACT

This general guide on curriculum construction states that while each country must organize its curriculum work along the lines it regards as most relevant for its special conditions, some factors are inherent in all curriculum planning. The report concentrates on two functions each country will have to provide: (1) the determination of the specifications for the curriculum, and (2) the evaluation of the effectiveness of learning materials and instructional procedures. Methods for meeting each of these aspects of curriculum construction are presented. (Author/MLF)

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The Fundamentals of Educational Planning : Lecture - Discussion Series

No 61 GENERAL PRINCIPLES OF CURRICULUM DEVELOPMENT

by T. Neville Postlethwaite

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GENERAL PRINCIPLES OF CURRICULUM DEVELOPMENT

by

T. Neville Postlethwaite
International Institute for Educational Planning

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I. INTRODUCTION

Each country must organize its curriculum work along the lines it regards as most relevant for its special conditions. Some countries will have highly centralized curriculum centres while others will attempt to provide for decentralized curriculum work. Some will place their curriculum work in the Ministry of Education; others will create National Centres located in some relation to the Ministry, the institutions of higher education, and the public-supported schools; while others will regard curriculum work as a series of special contract projects to be supported by public and private funds.

However it is organized, each country will have to provide for four functions:

(1) The determination of the specifications for the curriculum. This will include the content and objectives of the curriculum. This function requires a series of value decisions based on available evidence in the country, studies made of specific social and educational needs in the nation, expert opinions, and a body of theory and research on learning. This is the most fundamental set of problems in curriculum development and each nation may learn from the experience of other nations with these problems.

(2) The development of learning material and instructional procedures. This function requires highly skilled workers who can create materials and procedures which will serve the functions specified for the curriculum. It also includes the trying out of the materials and procedures under appropriate conditions with students and teachers to find ways of improving them and to determine the limitations and advantages of each set of materials and techniques. Again, each country can profit from the experiences of other countries and each country may contribute materials and ideas to other countries. This stage in curriculum development constitutes a technology which can be shared by all and which can be improved in a systematic way from year to year.

(3) The evaluation of the effectiveness of learning materials and instructional procedures. This function involves the careful use of evidence to determine the extent to which the curriculum has the intended effects on students. This stage in curriculum development includes the creation of appropriate evaluation techniques, the use of appropriate sampling procedures and research design, and the analysis of the evidence by appropriate statistical and data processing procedures. Of all the functions, this is one of the most highly developed international technologies which can be shared by countries possessing appropriately trained personnel.

(4) The in-service and pre-service training of teachers for curriculum changes. Each nation must find ways of bringing its teachers up-to-date on new subject matter, methods, and ideas finally used in the new curriculum developments. While this is not properly a part of curriculum development, it is clear that new instructional material and instructional methods cannot be used in the schools until the teachers have been prepared for the changes. Here again, each nation can profit from the experiences of other nations.

This lecture will concentrate on themes (1) and (3) mentioned above. The reason for this is that there has been much talk in the last few years on "modernising the curriculum to make it relevant to the needs of society" or, again, "correcting the imbalance of the existing curriculum". The thesis of the lecture is that, if themes (1) and (3) are carried out continuously and systematically, then the curriculum should be "relevant" and "balanced".

II. DEVELOPMENT

Deciding what is to be learned

If an educational programme is to be planned and if efforts for continued improvement are to be made, it is very necessary to have some conception of the goals that are being aimed at. These educational objectives become the criteria by which materials are selected, content is outlined, instructional procedures are developed and tests and examinations are prepared. All aspects of the educational programme are really means to accomplish basic educational purposes. Hence, if we are to study an educational programme systematically and intelligently, we must first be sure as to the educational objectives aimed at.

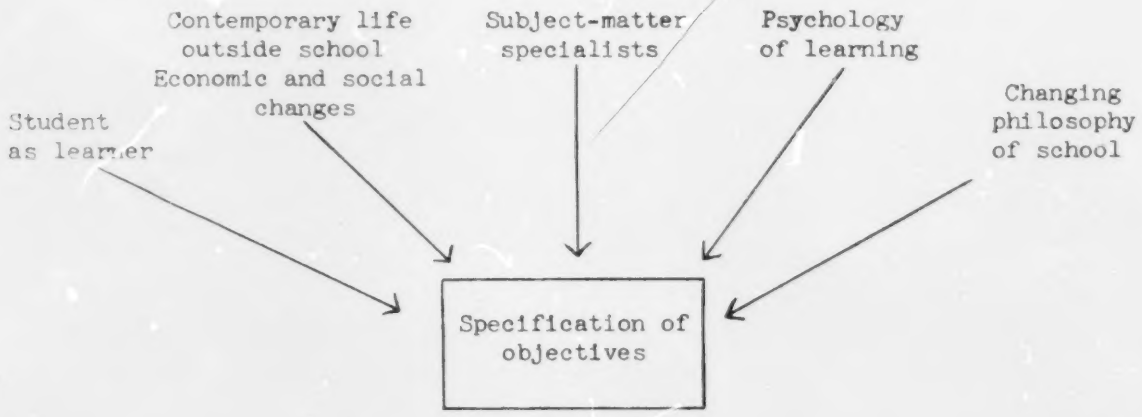
But how are objectives obtained? Since they are consciously willed goals, that is, ends that are desired by the school staff, are they not simply matters of personal preference of individuals or groups? Is there any place for a systematic attack upon the problem of what objectives to seek?

It is true that in the final analysis objectives are matters of choice and they must therefore be considered value judgements of those responsible for the school. A comprehensive philosophy of education is necessary to guide in making these judgements. And, in addition, certain kinds of information and knowledge provide a more intelligent basis for applying the philosophy in making decisions about objectives. If these facts are available to those making decisions, the probability is increased that judgements about objectives will be wise and that the school goals will have greater significance and greater validity.

Accepting this principle that investigations can be made which will provide information and knowledge useful in deciding about objectives, the question is then raised what sources can be used for getting information that will be helpful in this way.

There are many forces in society which conjoin to determine what will be taught at any one level in any one subject area. Consider Figure 1.

Figure 1. A selection of forces determining specific objectives of what is to be learned in school



Only five forces have been mentioned. Clearly, one could list more, and the critical forces will vary from society to society, but some will be always important. It is for each curriculum development group to decide on the major forces and examine them. (For more detailed reading on this, readers are referred to R.W. Tyler's 'Basic Principles of Curriculum and Instruction', University of Chicago Press, 1949).

Let us examine the five mentioned in turn:

(a) The student as a learner

One categorisation of student needs could be:

(i) Physical - e.g. the need for food, water, clothing, shelter, activity, etc.

(ii) Social - e.g. the need for affection, for status or respect, for a feeling of belonging, etc.

(iii) Integrative - e.g. the need to relate to something larger than beyond oneself, to find meaning in life, to "find" one's self; the need for a philosophy of life, etc.

(iv) Cognitive - knowledge and skills to master in order to earn a living and be a useful member of society.

(v) Affective - attitudes and values.

(vi) Psychomotor.

In each case studies can be conducted to discover the extent to which all students or sub-groups of students have their needs catered for. But studies of the learner suggest specific educational objectives only when the information about the learner is compared with some "desirable standards", some conception of acceptable norms, so that the difference between the present condition of the learner and the acceptable norm can be identified. This difference is the identified further need.

There is another aspect of the student as learner which consists of the relevance to himself or the contemporary world he sees in what he is learning. Two examples will suffice to clarify the point. Why should a student in an ex-colony continue to learn the history (or geography) of the former colonial power instead of his national history or geography? If, in a particular society, drug-taking becomes a problem, to what extent is a special curriculum produced and how quickly into the schools?

(b) Contemporary life outside the school

The rather complex and changing nature of contemporary life suggests that it is necessary to identify the demands that modern life makes upon young people and equip them to meet these demands and the opportunities they provide for development and expression.

What are the social and economic changes in recent years and what are the trends for the future? How do these changes influence what is taught in school? If new attitudes have been developed through health laws about hygiene, or if family planning is becoming accepted, how are these introduced into the curriculum and at what levels, as new subjects or in association with what traditional subjects? If, in manpower employment, the main employer is now tourism as opposed to sugar cane production, how does this influence the curriculum? Such knowledge and skills changes can be identified by, for example, first of all identifying employment changes and predicted changes and then undertaking studies of the types of knowledge and skills required and, in turn, entering them into the curriculum at various points. (cf. U. Dahllöf's 'Demands on the Gymnasium', Stockholm, 1963).

(c) Suggestions about objectives from subject-matter specialists

School textbooks are usually written by subject specialists and, hence, their impact has been great. Indeed, over 90 per cent of learning materials have, in most countries, been produced only by subject specialists.

Many people have criticized the use of subject specialists on the grounds that the objectives they propose are too technical, too specialized, or in other ways are inappropriate for a large number of the school students. Probably the inadequacy of many lists of objectives suggested by subject specialists grows out of the fact that these specialists have not been asked the right questions. Often they have thought they were answering the question: What should be the elementary instruction for students who are later to carry on much more advanced work in the field? Hence, a report in History, for example, seems to present objectives for the beginning courses for persons who are training to be historians. Similarly, a report in Mathematics outlines objectives for the beginning courses in the training of a mathematician. Apparently subject specialists often viewed their job as outlining the elementary courses with the idea that these students, taking these courses would go on for more and more advanced work, culminating in major specialization at the college or university level. This is obviously not the question that subject specialists should generally be asked regarding the secondary school curriculum. The question which they should be asked runs somewhat like this: What can your subject contribute to the education of young people who are not going to be specialists in your field; what can your subject contribute to the layman, the garden variety of citizen? If subject specialists can present answers to this question, they can make an important contribution because, presumably, they have a considerable knowledge of the specialized field and many of them have had opportunity both to see what this subject has done for them and for those with whom they work. They ought to be able to suggest possible contributions, knowing the field as well as they do, that it might make to others in terms of its discipline, its content and the like.

At this point, it would be well to indicate the sorts of specifications of objectives we are aiming at. The work of Bloom and his colleagues(1) has helped the field advance a great deal. In the work of cognitive processes, for example, Bloom has proposed a hierarchy of objectives, for any one content area:

(i) Knowledge (ii) Comprehension	usually referred to as lower mental processes
(iii) Application (iv) Analysis (v) Synthesis (vi) Evaluation	usually referred to as higher mental processes

(1) Bloom, B.S. (ed.) Taxonomy of educational objectives : cognitive and affective domains, David McKay & Co. Inc., New York, 1956 and 1964.

Similar taxonomies have been proposed for both the affective and psychomotor domains.

Figure 2 (pages 8 and 9) presents a large content area/objective matrix for Science (taken from Bloom's 'Handbook of Formative and Summative Evaluation of Student Learning', 1971). Figure 3 (page 10) presents a reduced Science matrix and Figure 4 (page 11) presents a foreign language specification matrix (again taken from Bloom's Handbook).

Thus when we speak of specification of objectives it is, first of all, arriving at matrices such as those presented in Figures 2-4 and, secondly, identifying which cells are to be presented in which "units" in which sequencing in which grade.

(d) The psychology of learning

Educational objectives are educational ends, they are results to be achieved from learning. Unless these ends are in conformity with conditions intrinsic in learning, they are worthless as educational goals.

At the lowest extreme a knowledge of the psychology of learning enables us to distinguish changes in human beings that can be expected to result from a learning process from those that cannot. For example, it is quite clear that young people may develop health habits and health knowledge through a learning process. On the other hand, they cannot increase their height directly by a learning process. Young children can learn to channel their physical reactions in more socially desirable directions as a matter of learning, but it is not possible through learning to inhibit physical reaction altogether. The old school of thought which attempted to teach children to be utterly quiet while they were in school was imposing an educational objective impossible of attainment.

At a higher level, a knowledge of the psychology of learning enables us to distinguish goals that are feasible from those that are likely to take a very long time or are almost impossible of attainment at the age level contemplated. For example, the personality structure of children is capable of a good deal of modification through educational experiences during the nursery and primary school period, but educational objectives which aim at profound changes in the personality structure of a 16-year-old are largely unattainable. At 16, so much of the development of the personality has already taken place that the re-education of basic personality structure is a very difficult task and unlikely to be attained through a normal school programme.

Another illustration of the contribution of psychology of learning to conditions requisite for attaining given objectives can be given from studies of the time required to bring about certain types of changes in young people. It has been shown, for example, that to change the basic attitudes of children requires continuous emphasis extending over several years. In general, basic attitudes are not markedly shifted by one, two, three or four months of instruction. In similar fashion, data have been obtained regarding the time involved in bringing about other types of behaviour changes, such as ways of thinking and study, basic habits and practices, interests and the like. Obviously, psychological knowledge of this sort is useful in suggesting the length of time over which particular objectives will need to be emphasized.

Another finding about learning conditions which has importance in selecting objectives is the evidence that learnings which are consistent with each other, which are in that sense integrated and coherent, reinforce each other; whereas learnings which are compartmentalized or are inconsistent with each other require greater time and may actually interfere with each other in learning. This suggests what may also be suggested by one's philosophy of education, that the various objectives be examined to see that they are mutually consistent and that they permit some degree of integration and coherent unification in the mind and action of the student so that the maximum psychological benefit of learning can thus be derived.

Readers may well be interested in perusing Havighurst's 'Developmental Tasks and Education', David McKay Company Inc., New York, 1952.

(e) Changing philosophy of school

A classic example of this phenomenon must be well known to most of you. A school system has been receiving about 80 per cent of an age group to primary school - only 5 per cent have proceeded to secondary school. A political decision is introduced whereby 100 per cent of an age group will have six years of compulsory primary education, but still only 5 per cent will continue to secondary school. The primary schooling then becomes an end in itself. What are the objectives which every child should master by the end of the six years.

Educational philosophy serves other functions in the curriculum proposal. Suggestions regarding objectives obtained from various sources (students, subject specialists, contemporary life, political and social groups, etc.) prove to be incompatible with others and at any rate cannot all be followed because of time constraints. It is, therefore, necessary to choose a few consistent objectives and set priorities between them.

BEHAVIOR
A.0 Knowledge and comprehension
B.0 Processes of scientific inquiry
B.1 Observing and measuring
C.0 Processes of scientific inquiry II Seeing a problem and working ways to solve it
A.1 Knowledge of specific facts
A.2 Knowledge of scientific terminology
A.3 Knowledge of concepts of science
A.4 Knowledge of conventions
A.5 Knowledge of trends and sequences
A.6 Knowledge of classifications categories and criteria
A.7 Knowledge of scientific techniques and procedures
A.8 Knowledge of scientific principles and laws
A.9 Knowledge of theories or model conceptual schemes
A.10 Identification of knowledge in a new context
A.11 Translation of knowledge from one symbolic form to another
B.1 Observation of objects and phenomena
B.2 Description of observations using appropriate language
B.3 Measurement of objects and characteristics
B.4 Selection of appropriate measuring instruments
B.5 Estimation of measurements and recognition of limits in accuracy
C.1 Recognition of a problem
C.2 Formulation of a working hypothesis
C.3 Selection of suitable tests of a hypothesis
C.4 Design of appropriate procedures for performing experiments
CONTENT
1.0 Biological sciences
1.1 Biology of the Cell
1.11 Cell Structure and Function
1.12 Transport of Cellular Material
1.13 Cell Metabolism
1.14 Photosynthesis
1.15 Cell Reproduction
1.16 Genetics of the Cell
1.2 Biology of the Organism
1.21 Diversity of Life
1.22 Metabolism of Organisms
1.23 Reproduction of Organisms
1.24 Classification and Behaviour
1.25 Reproduction and Development
1.26 Human Biology
1.3 Biology of Populations
1.31 Natural Environment
1.32 Cycles in Nature
1.33 Natural Groups and Their Modification
1.34 Population Genetics
1.35 Evolution
2.0 Physical sciences
2.1 Chemistry
2.11 Chemical Materials
2.12 Classification of Chemical Elements
2.13 Chemical Change
2.14 Chemical Laws
2.15 Energy Relationships and Equilibrium in Chemical Systems
2.16 Electrochemistry
2.17 Atomic and Molecular Structure
2.18 Introduction to Organic Chemistry
2.19 Chemistry of Life Processes
2.110 Nuclear Chemistry
2.2 Physics
2.21 Kinematics
2.22 Dynamics
2.23 Forces and Its Conservation
2.24 Mechanical Advantage
2.25 Mechanics of Fluids
2.26 Heat and Kinetic Theory
2.27 Wave Phenomena
2.28 Sound
2.29 Light and Spectra
2.210 Static and Current Electricity
2.211 Magnetism and Electromagnetism
2.212 Electronics
2.213 Properties and Structure of Matter
2.214 Elementary Particles
2.3 Earth and space sciences
2.31 Solar System
2.32 Stellar Systems
2.33 Meteorology
2.34 Physical Geology
2.35 Historical Geology
2.36 Geophysics and Geochemistry
2.37 Oceanography
3.0 Technology
3.1 Historical Development
3.2 Nature and Practice of Technology
3.3 Nature of Scientific Inquiry
3.4 Biographies of Scientists
3.5 Measurement

* Some of the evident behaviours are given here in abbreviated form. For complete wording, especially of behaviours A.10, A.11, B.4, B.5, and C.1 to C.3, see pages 585-586.

Figure 2. Table of specifications for science education

BEST COPY AVAILABLE

BEHAVIOR*

D.0 Processes of scientific inquiry. III. Interpreting data and formulating generalizations						E.0 Processes of scientific inquiry. IV. Building, testing, and revising a theoretical model						F.0. Application of scientific knowledge and methods			G.0 Manual skills		H.0. Attitudes and interests						I.0. Orientations				
Processing of experimental data	Presentation of data in the form of functional relationships	Interpretation of experimental data and observations	Extrapolation and interpolation	Evaluation of a hypothesis under test in the light of data obtained	Formulation of generalizations warranted by relationships found	Recognition of the need for a theoretical model	Formulation of a theoretical model to accommodate knowledge	Specification of relationships satisfied by a model	Deduction of new hypotheses from a theoretical model	Interpretation and evaluation of tests of a model	Formulation of a revised, refined, or extended model	Application to new problems in the same field of science	Application to new problems in a different field of science	Application to problems outside of science (including technology)	Development of skills in using common laboratory equipment	Performance of common laboratory techniques with care and safety	Manifestation of favorable attitudes toward science and scientists	Acceptance of scientific inquiry as a way of thought	Adoption of scientific attitudes	Enjoyment of science learning experiences	Development of interests in science and science related activities	Development of interest in pursuing a career in science	Relationships among various types of statements in science	Recognition of the philosophical limitations and influences of scientific inquiry	Historical perspective on evolution of the basic concepts in science	Realization of the relationships among science, technology, and economics	Awareness of the social and moral implications of scientific inquiry, and its results
D1	D2	D3	D4	D5	D6	E1	E2	E3	E4	E5	E6	F1	F2	F3	G1	G2	H1	H2	H3	H4	H5	H6	I1	I2	I3	I4	I5

Enter 0, 1 or 2 in each section of each box.

0 indicates that this topic, interpreted as described in the explanatory notes for the population in question, is not normally studied with this particular objective in mind at this sampling level.

1 indicates that this topic is included in the Science curriculum at this level with this particular objective in mind but is regarded as of slight to moderate importance.

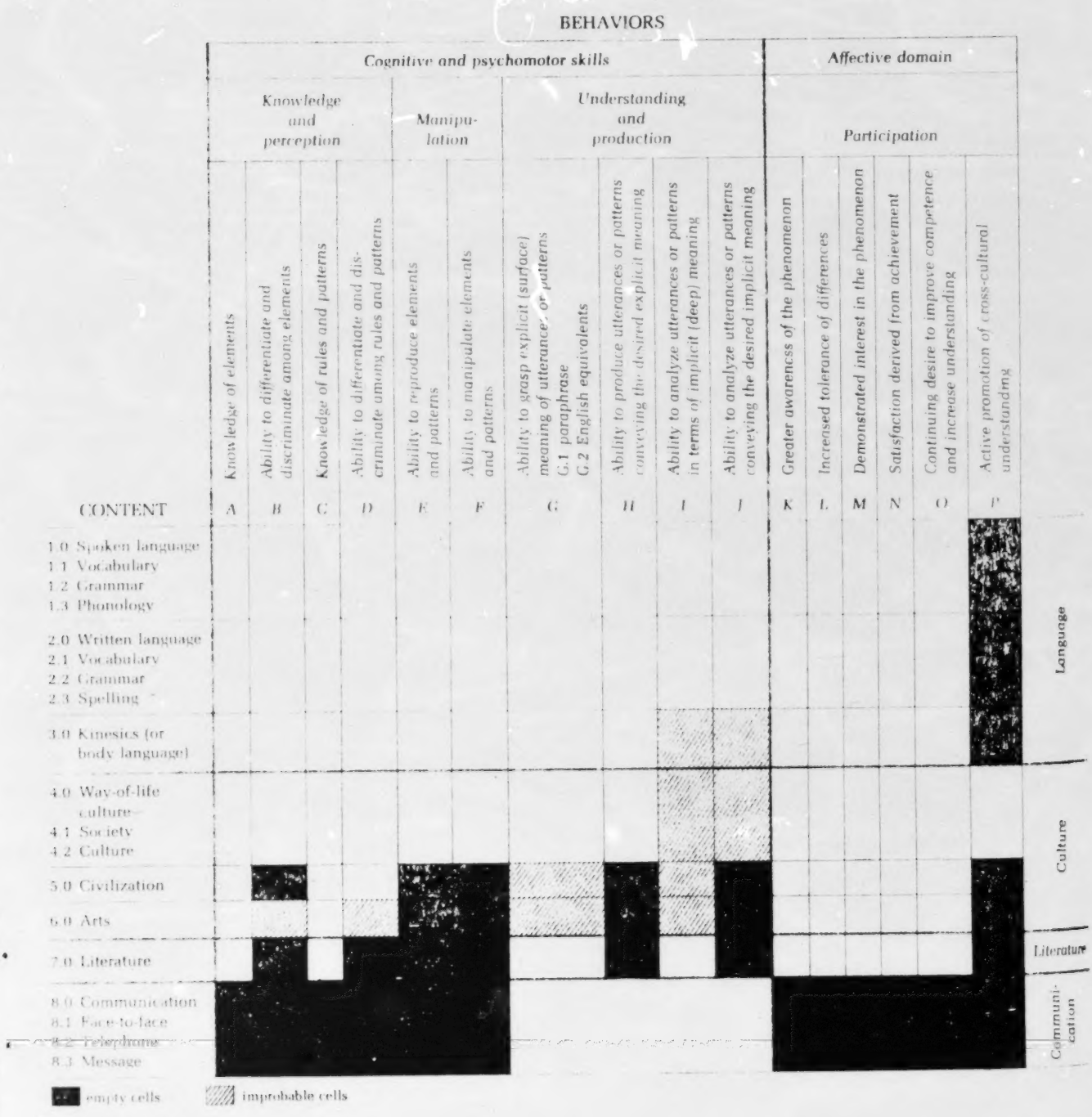
2 indicates that this topic is included in the Science curriculum at this level with this particular objective in mind and is regarded as of major importance.

Subject areas	Objectives							
	1 Obtaining Scientific Information	2 Interpreting Scientific Information	3 Theorization Construction	4 Theorization Utilization	5 Comprehension	6 Application of Scientific Knowledge	7 Personal and Social Objectives	8 Philosophical Aspects
Earth Sciences								
1. Solar system								
2. Stellar systems								
3. Meteorology								
4. Earth's crust								
5. Physical Geography and Geology								
6. Soil Sciences								
Biological Sciences								
7. Cell structure and function								
8. Homeostasis								
9. Cell metabolism								
10. Cell responses								
11. Concept of the gene								
12. Diversity of life								
13. Metabolism in organisms								
14. Regulation in organisms								
15. Co-ordination and behavior								
16. Reproduction and development								
17. Human Biology								
18. Natural environment								
19. Cycles in nature								
20. Natural groups and their segregation								
21. Population genetics								
22. Evolution								
Physical Sciences:								
Chemistry								
23. Chemical change								
24. Electro-Chemistry								
25. Chemical laws								
26. Chemical processes								
27. Periodic system								
28. Energy relationships in chemical systems								
29. Rate of reaction								
30. Raw materials and chemical substances								
31. Chemical structure								
32. Polymerization and polymers								
33. Chemistry of life processes								
34. Nuclear Chemistry								
Physics								
35. Measurement								
36. Time and movement								
37. Forces								
38. Dynamics								
39. Energy and machines								
40. Mechanics of fluids								
41. Introductory heat								
42. Change of state								
43. Kinetic theory								
44. Light								
45. Vibration and sound								
46. Wave phenomena								
47. Spectra								
48. Static electricity								
49. Current electricity								
50. Magnetism, electro-magnetism and alternating currents								
51. Electronics								
52. Molecular and Atomic Physics								
53. Theoretical Physics								

Source: Comber, L.C. and J.P. Keeves, Education in nineteen countries, International Studies in Evaluation I, Appendix II, Stockholm, Almqvist & Wiksell, New York, Halsted Press, John Wiley & Sons Inc.

Figure 3. Subject area/behavioural objective grid

Figure 4. Table of specifications for second language instruction



Source: Bloom, B.S., Handbook of formative and summative evaluation of student learning, McGraw Hill.

This choice implies a value judgement which is based on the educational and social philosophy to which the choosing person is committed. Provided an adequate formulation of this educational and social philosophy, the set of values education should seek to attain is given. These values serve as selection criteria for every proposed objective, checking whether it is consistent with, in opposition to, or unrelated to them. Thus, some proposals will be accepted, others rejected and priorities set among the accepted objectives.

Values on which decisions must be based will include:

Transfer of traditional values	-	demands of contemporary life
General education of the citizen	-	training of specialists
Spiritual values	-	material values
Personal satisfaction	-	social success
Faith in intelligence as a method of dealing with problems	-	personal authority of an autocratic or aristocratic group
Teaching "without value judgement"	-	"indoctrination"
Acceptance of given social order by the educated	-	"revolutionary mission" of the school
Common democratic education for all people	-	different education for different social classes

Bringing forces together

Again, it must be emphasized that the five forces or sources of information are five arbitrarily chosen ones, but possibly of universal interest. It is for each country to decide on the critical sources to be examined for its society or various sub-societies. In the last resort, it will be a set of value judgements which bring together the various sets of information to finalise the specifications of objectives.

Let us return now to the concepts of balance and relevancy. How does the foregoing ensure this? Typically, a group of curriculum developers will decide on the subjects to be taught at any one grade level. This is fine and a necessary first step. But as each segment of the curriculum is subjected to the type of systematic development mentioned above, it may well turn out that certain parts require more time and other parts less time. But the "appropriate" balance will emerge. It is not enough to say that the balance of the curriculum should be redressed by the introduction of business education, workshop and home economics. If these were required they would have emerged from the development undertaken. Again, what might be appropriate now may

not be appropriate (relevant) in five years time. There needs to be a continuous (cyclic) re-examination of the total curriculum built in to any education system.

The broader meaning of curriculum

So far we have dealt with the specifications of objectives. There are, of course, other related aspects of curriculum development which are of paramount importance. The other important aspects are: the writing of the materials, the structuring of the learning environment, the continuous evaluation of the materials to ensure that they are "working" with the students for whom they are destined, and the pre-service and in-service training of the teachers who are to realise the revised or new curricula in the classrooms.

This can be exemplified by a diagram (Figure 5) produced by Harold Foecke, Director, Division of Pre-university Science and Technology Education (STE), Unesco.

III. EVALUATION

Assume that the objectives for any one learning unit have been agreed, and that the first units have been written together with accompanying teacher manuals. They must, of course, be tried out. Let us take a simple example. Assume that a Grade 8 course in Physics has been written. Assume also that in a country there is an ability range of students in Grade 8 which is highly correlated with the socio-economic status of the students' parents and that in turn this is correlated with the urban-rural distribution of occupations. Here then are three variables which are thought to be important: ability, socio-economic status, and rural-urban location of school. Although all schools are co-educational, it is known that in general boys perform better than girls in Science. Here then is a fourth variable of interest to us: sex. If the Physics course is meant to "work" for all students in Grade 8 in the country (one can, of course, define the particular target population in any way one wants, but this must be done before the whole development process begins), then a small judgement sample of classes must be chosen. Figure 6 represents a possible sample of classes.

Figure 5. Designing the programme

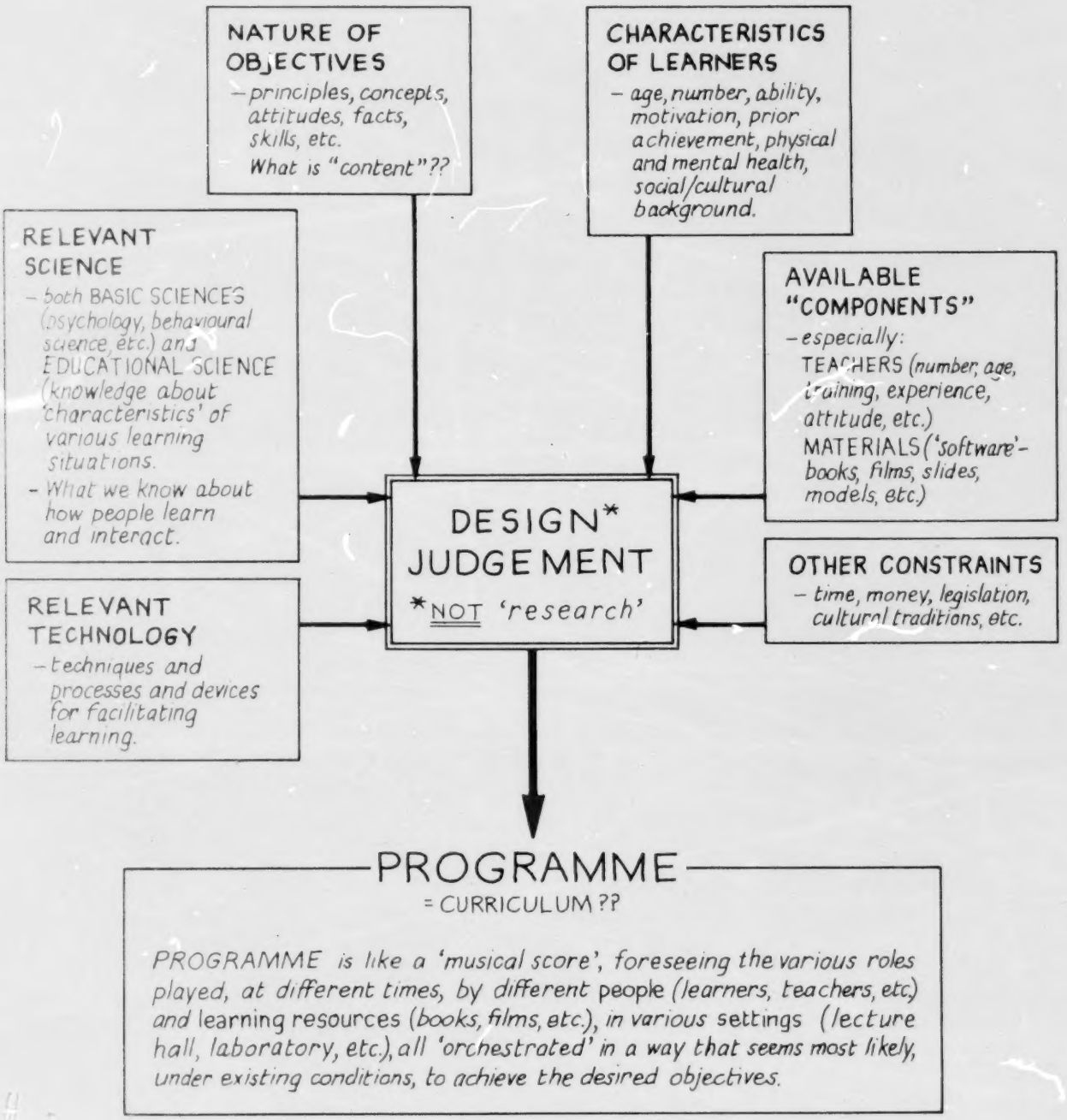
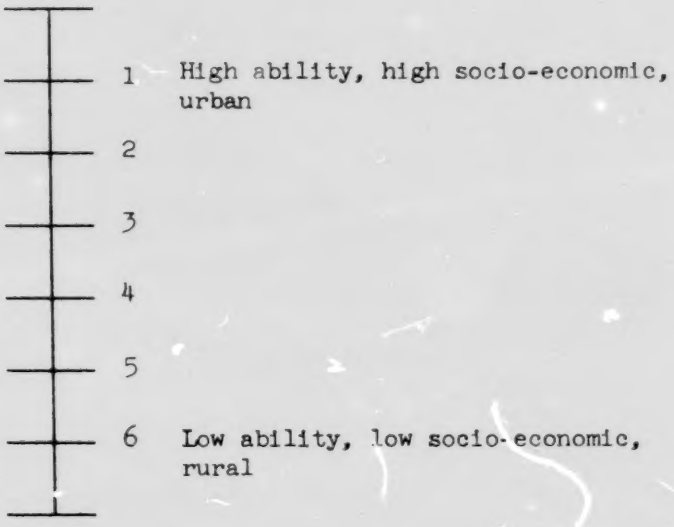

NATURE OF OBJECTIVES
– principles, concepts, attitudes, facts, skills, etc.
What is "content"??
CHARACTERISTICS OF LEARNERS
– age, number, ability, motivation, prior achievement, physical and mental health, social/cultural background.
RELEVANT SCIENCE
– both BASIC SCIENCES (psychology, behavioural science, etc.) and EDUCATIONAL SCIENCE (knowledge about 'characteristics' of various learning situations.
– What we know about how people learn and interact.
AVAILABLE "COMPONENTS"
– especially:
TEACHERS (number, age, training, experience, attitude, etc.)
MATERIALS ('software' – books, films, slides, models, etc.)
DESIGN* JUDGEMENT
*NOT 'research'
OTHER CONSTRAINTS
– time, money, legislation, cultural traditions, etc.
RELEVANT TECHNOLOGY
– techniques and processes and devices for facilitating learning.
PROGRAMME
= CURRICULUM??
PROGRAMME is like a 'musical score', foreseeing the various roles played, at different times, by different people (learners, teachers, etc.) and learning resources (books, films, etc.), in various settings (lecture hall, laboratory, etc.), all 'orchestrated' in a way that seems most likely, under existing conditions, to achieve the desired objectives.

Figure 6. Selection of classes across selected important variable ranges



The actual variables used to select schools will vary from society to society and it is up to the curriculum developers to decide which are the critical variables. The teachers from these classes are instructed by the curriculum developers on the sequencing of the special curriculum in Physics, together with apparatus needed, particular methods of presentation, etc. The instruction then takes place. However, throughout the instruction a set of checks and evaluation are conducted. Since the curriculum is meant to be mastered by at least 90 per cent of all students, each teacher keeps a record of difficulties of parts of the course for all students or some of them. At the same time the school principal reports any difficulties he notices in terms of any disruption to the normal working of the school. But the most important aspect of how the curriculum is "working" is dependent on the learning of the children. Since the specific objectives of each part of the new curriculum are known, it is possible to test to what extent the children have mastered a particular example. If one of the objectives was to understand the principle of "forces" in the Physical Sciences, an item such as the following might be used to test whether such understanding had occurred:

Ann was playing with a bubble pipe. When the bubble was the size of the one in the picture, she took the pipe out of her mouth.
What do you think happened to the bubble *after* that?

A. It got larger for a time and then stayed at this size
B. It got smaller for a time and then stayed at this size
C. It got smaller and smaller and disappeared into the pipe
D. It stayed on the pipe without getting larger or smaller
E. It became larger and larger till it burst

Let us hypothetically assume the following percentages of students succeeding:

Total	Boys	Girls	Urban	Rural	Socio-econ. status		
					1	2	3
75	83	67	79	71	85	75	65

These figures would indicate that:

(a) The learning materials are not working well enough for the target population for this objective since we decided that at least 80 per cent should master it.

(b) Whereas the materials are working for boys they should be improved to increase the girls performance.

(c) The materials need modification to help rural children and children from lower social classes.

If we were to average student scores within each of the six pilot classes, we may get:

Class 1	2	3	4	5	6
100	60	40	70	95	85

Clearly, something has gone sadly wrong in Class 3 and the curriculum developers will need to go through with the teacher the sequence of steps the teacher and students went through. When the faults are discovered the teacher manuals and/or learning materials can be modified to ensure that such errors cannot occur in the future. Conversely, Class 1 has done very well and it would be important to discover what happened there for such good results to be obtained and the extra actions undertaken by the teacher of Class 1 can also be built into the manuals/materials.

The materials and manuals must then be revised and again tried out, possibly on some thirty to forty classes the second time. The elementary analysis should be undertaken again and the exercise repeated until at least 80 per cent of students of both sexes, urban and rural regions, and all socio-economic groups have achieved the given objective. Then, assuming that teachers and school principals are happy with the materials and procedures and all objectives in the course have been mastered the course "works" and is ready to be implemented.

Rolling reform

A course which is "relevant" to-day may not be relevant in four or five years time. Each course needs to be systematically checked in terms of the procedures outlined above every so many years.

IV. CONCLUSION

This article has touched on only two aspects of curriculum construction. No mention has been made of the structuring of the learning environment, the pre- and in-service training of teachers, the type of educational research which can be undertaken to view curriculum in the wider context of all in-school and out-of-school activities, the running of a curriculum centre and the implementation of a curriculum across all schools in a specified target population.

However, the concepts are important in terms of the curriculum being relevant to the society's needs. It is the personnel of the country itself which should undertake the work and have such procedures built into the whole of primary and secondary schooling. Where curriculum centres undertake such systematic work it is of interest to note that the budget of the curriculum centre is typically one-half of one percent of the total primary and secondary school budget.